National Science Experiment

Mode B Device User Manual

Singapore University of Technology and Design

SINGAPORE UNIVERSITY OF TECHNOLOGY AND DESIGN

A*STAR Institute of High Performance Computing

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Mode B - Flashing Instructions

Setup Requirements:

1. Laptop (Windows only)
2. Download the sensg_firmware package from the NSE website (Downloads section).
3. SENSg Device
4. USB cable
5. Paper clip (2)

Procedure

1. Connect the device to the PC using the micro USB cable.
2. Unzip the sensg_firmware package to find the below-mentioned files
    i. DFuSe demo software – Software tool to perform firmware upgrade
    ii. Device firmware for Mode-A and Mode-B
3. Install theDFuSe demo software and run the application.

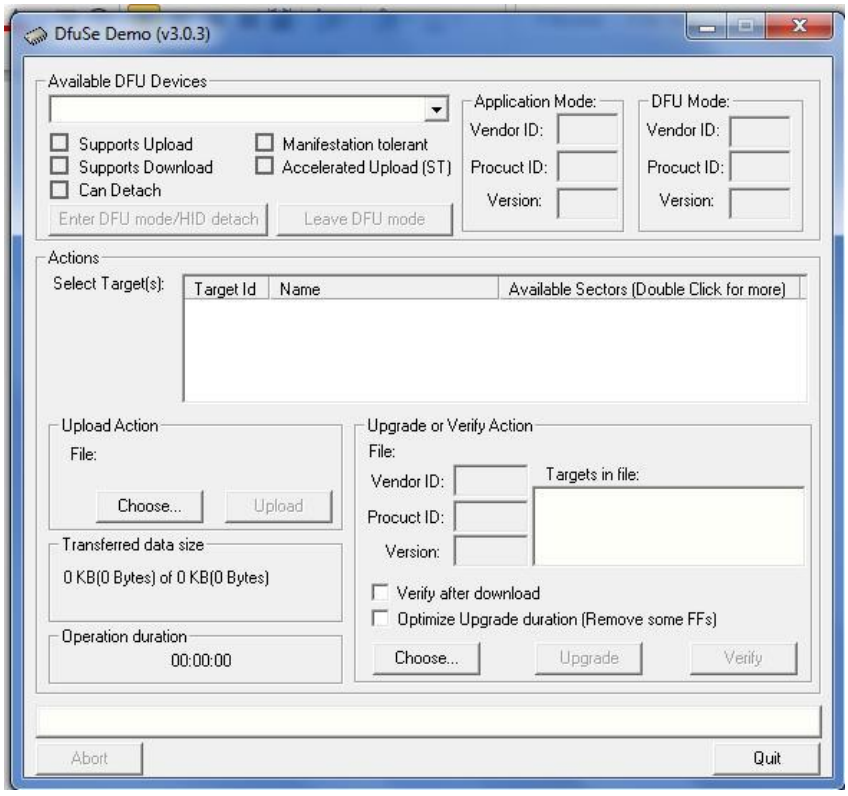


Figure 1: DFUSe Demo: Tool to perform software upgrade

4. Configure the device

a) Turn off the device using the power switch found at the bottom of the device.
b) The software upgrade enable button is found on the right-hand side and is accessible via a small hole. Use a paper clip to gently press the button.
c) While you continue to press the button, turn on the device.

Figure 2: SENSg device

Note: Do not damage the device while using the paper clip to press the button.

d) Red Led will turn on if the above procedure is followed correctly. If not, kindly repeat from step A. (Both LEDs shall turn red in colour)

Figure 3: Device LED status when in software upgrade mode

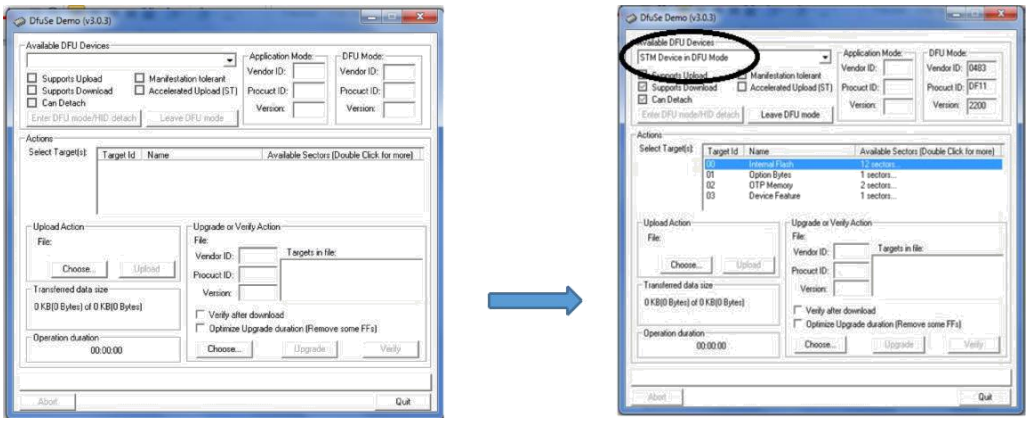


Figure 4 : DFuSe Demo : Device is identified and listed as STM32 device

5. Click on “Choose…” option to navigate and select the corresponding firmware version (Mode-A.dfu or Mode-B.dfu).Once selected click on “Upgrade” button.

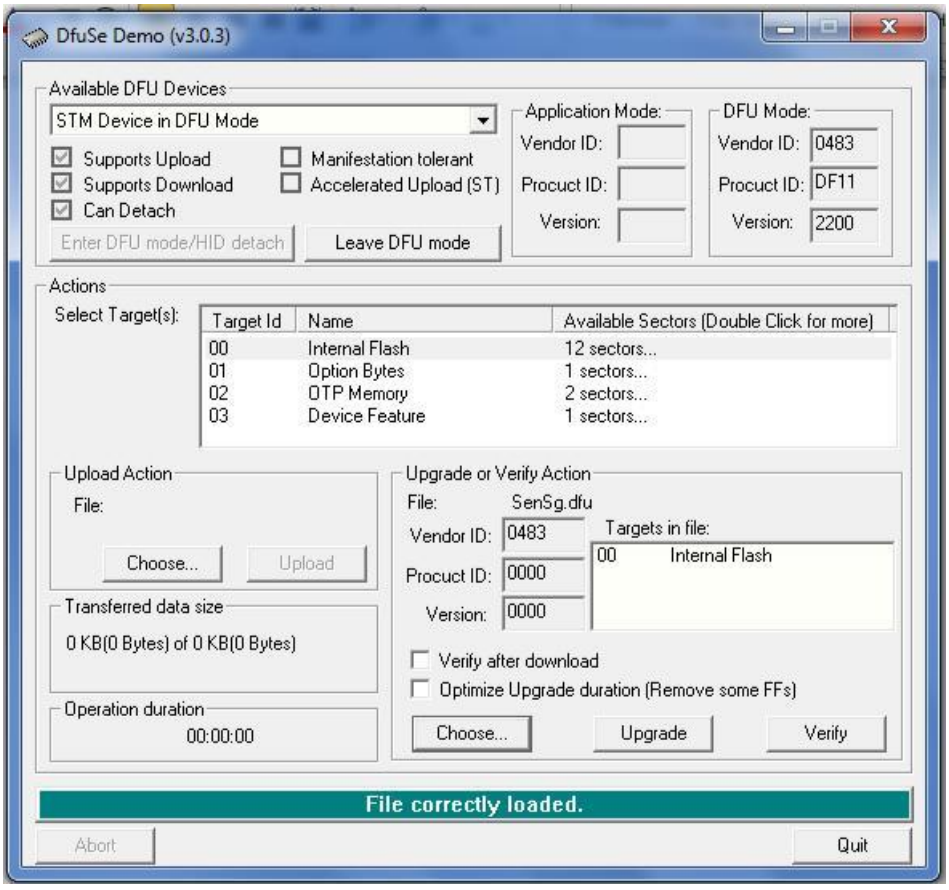
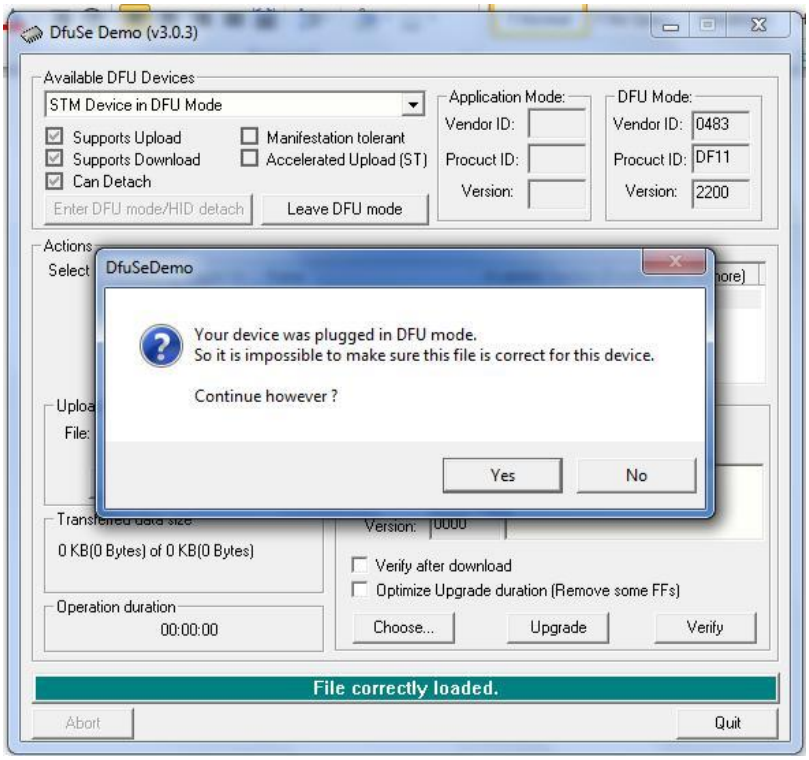
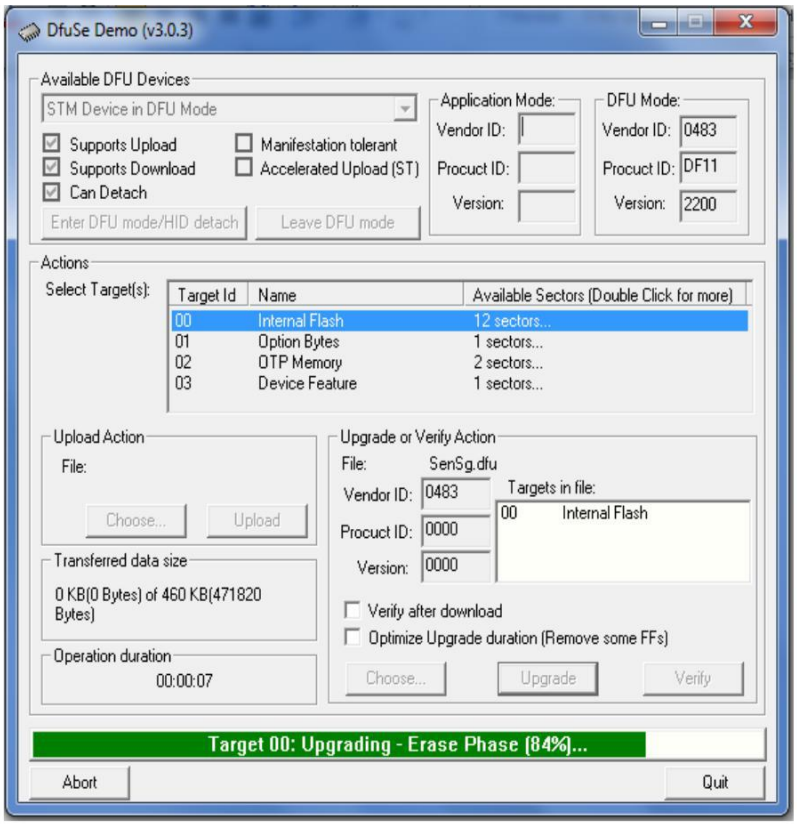


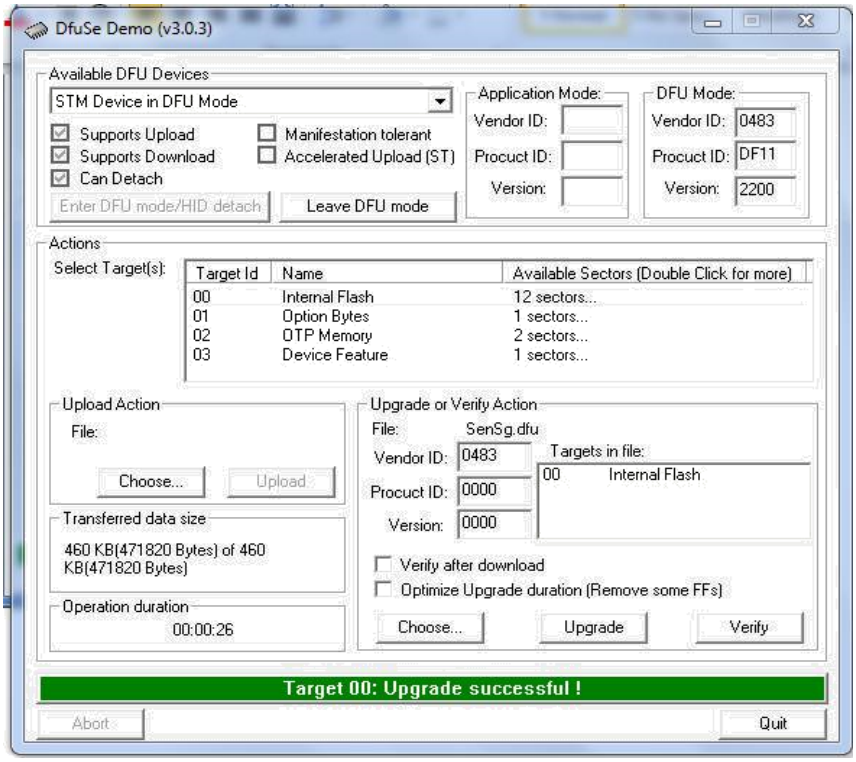
Figure 5 : DFuSE demo - Select firmware

6. Now select “Yes”.

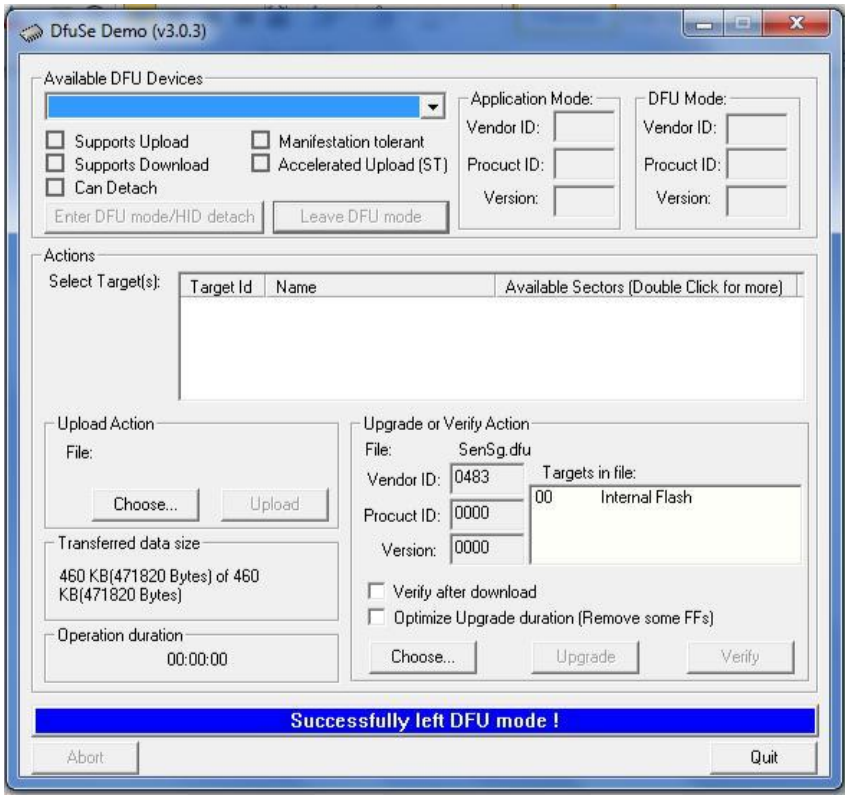


7. Now the Software upgrade process shall begin.





8. After the “Upgrade successful!” message select option “Leave DFU mode”. The message displayed would be “Successfully left DFU mode !”



Mode-B device testing Instructions

Prerequisites:

1. SENSg device flashed with the Mode B firmware.
2. Create a Wi-Fi hotspot on your mobile phone with the following credentials:
   Hotspot name: NSE_OPEN
   Password: hotspot_nse
3. Some Apparatus to vary the environmental parameters around the device like torch, magnet, Jug/Kettle.
4. Pencil / Paperclip to turn on the device.

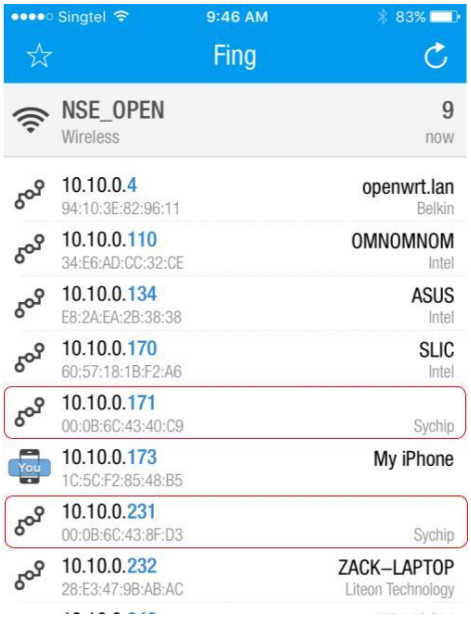
Setting up a Wi-Fi hotspot

Switch on your mobile phone/router and configure the network to 'NSE_OPEN' with the password 'hotspot_nse'. If you need instructions on how to configure a mobile hotspot:

For Android: http://www.androidauthority.com/mobile-hotspot-android-hotspot-android-customization-631280/

For iOS: https://support.apple.com/en-us/HT204023

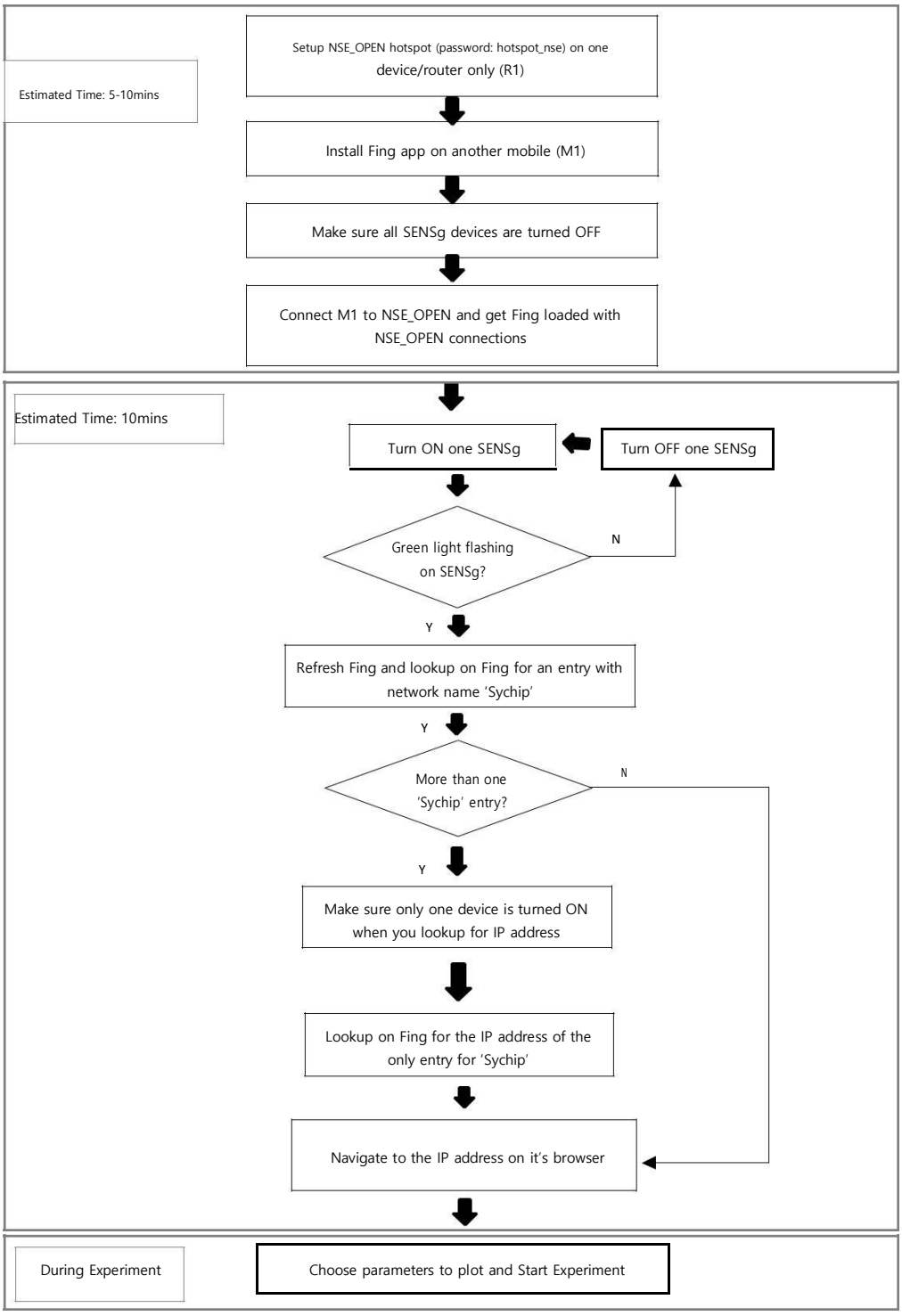
Starting with the SENSg powered off, use a pen or pencil to carefully toggle the switch found at the bottom of the SENSg device to the 'ON' position. Make sure there is only one NSE_OPEN hotspot setup in the vicinity when you do. Wait for the green light to flash on the SENSg to confirm that the device is connected to the NSE_OPEN hotspot.



Download and install the software 'Fing' (https://www.fing.io) on an another device (mobile/laptop), connect the device to the same hotspot and lookup on Fing which devices are connected to the hotspot with the name 'sychip' and record it's IP address.

On your phone or laptop's browser enter the IP address assigned to the device. (If you are using a laptop, make sure the laptop is connected to the same mobile hotspot as well.)

Process flow



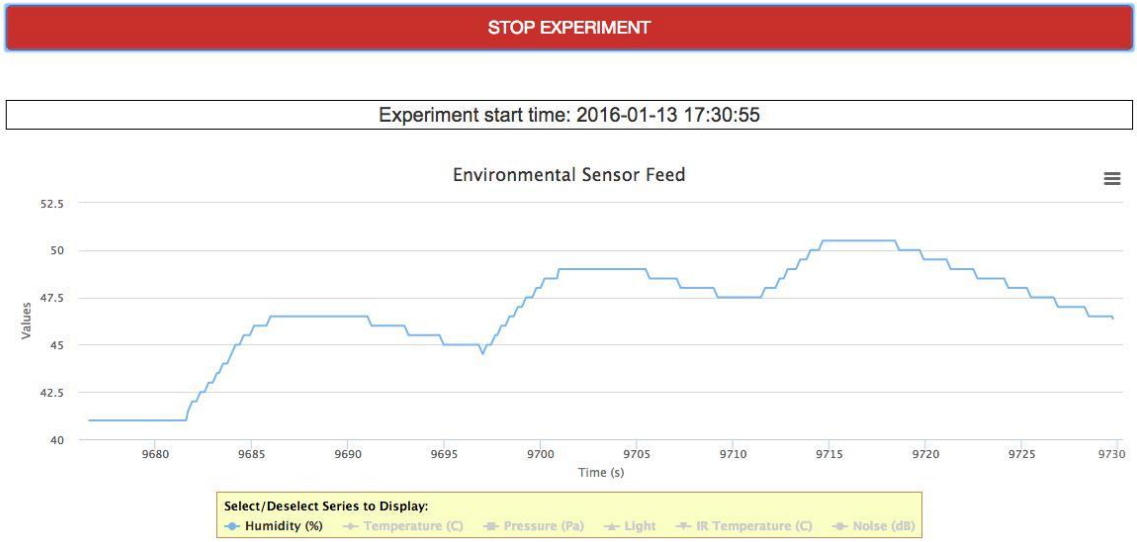
NOTE: 1. At the end of the experiment kindly turn off the device.

2. SENSg will blink red (on the right side) if the device requires charging. There will be a constant red light on the left side while it's charging

Sensor experiments

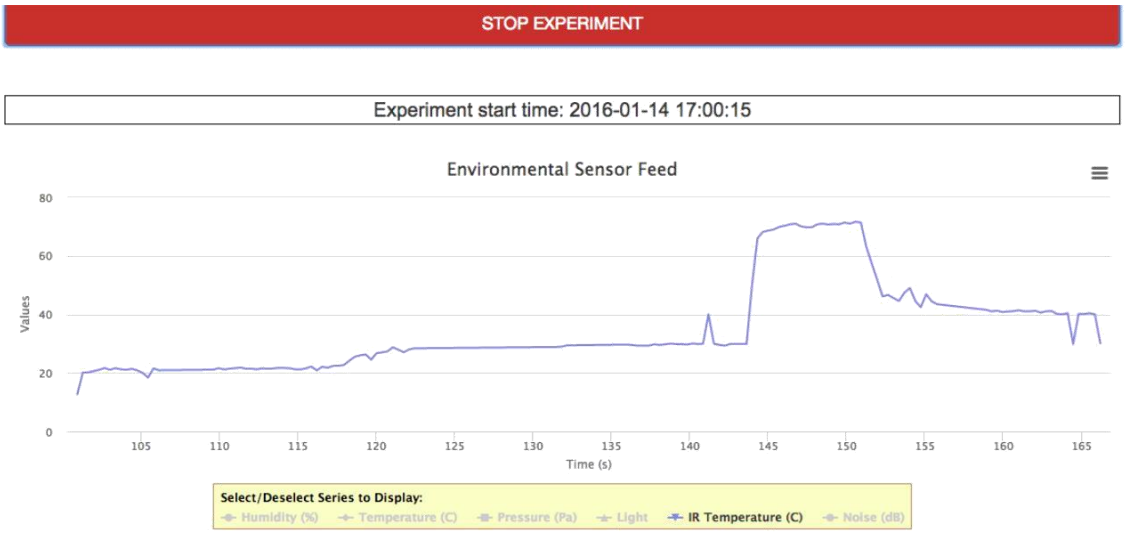
Humidity Test

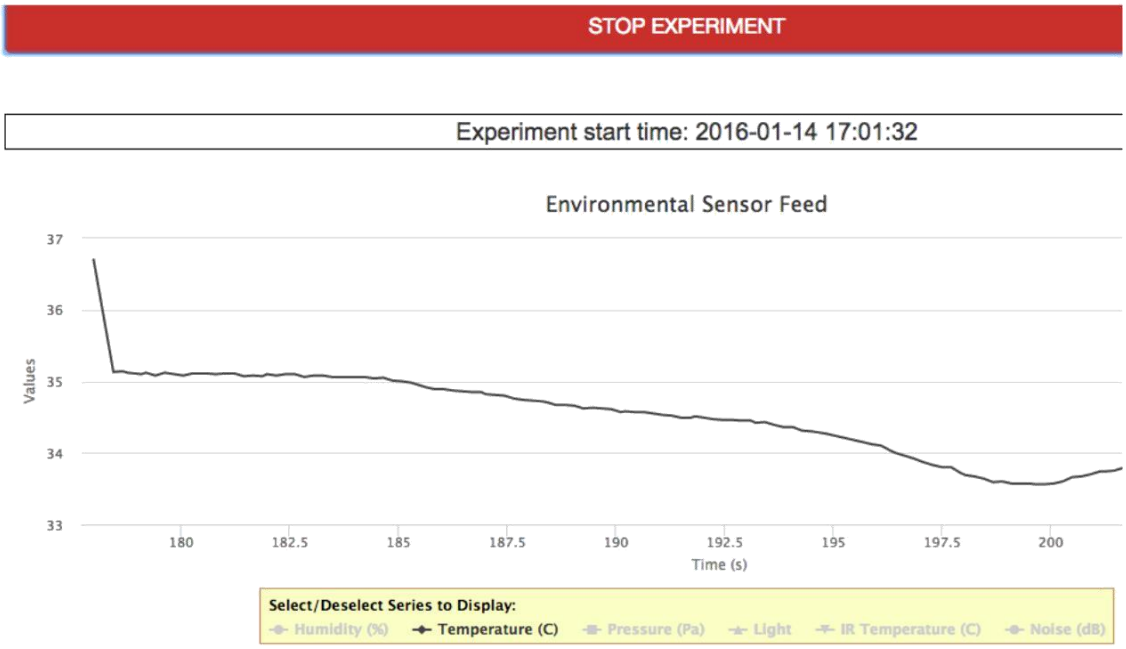
1. Refresh the browser, choose Humidity in the selection menu and Start Experiment.
2. Wait till the plot gets stabilised (roughly constant reading across time).
3. Breath out to the SENSg device (to the side with the SENSg label)
4. You should see a rise in the reading when you breathe out.
5. Repeat this again and you should notice a rise every time you breath out.



Temperature and IR Temperature

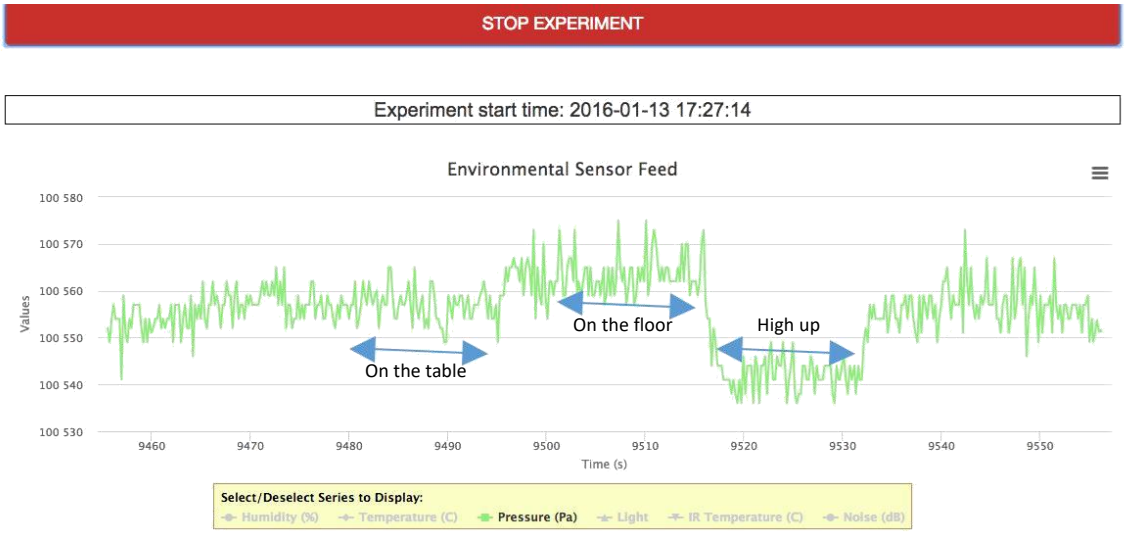
1. Refresh the browser, choose IR Temperature from the sensor selection menu and Start Experiment
2. Wait till the plot gets stabilised (roughly constant reading across time).
3. Place the SENSg device very close to the surface of a hot cup of water/tea with the ‘SENSg’ label facing the hot water/tea. Make sure the water/tea is still hot when you are doing this.
4. You should see a rise in the reading
5. Refresh, choose Temperature and Start Experiment
6. Place the SENSg in front of the fan and see if you notice a gradual drop in the temperature





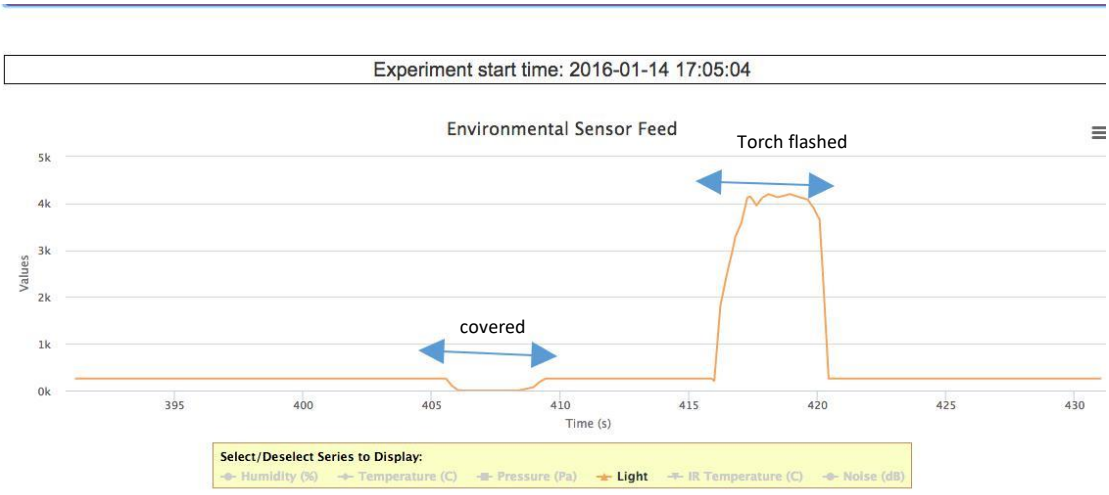
Pressure

1. Refresh the browser, choose pressure from the sensor selection menu and Start Experiment
2. Place the SENSg device on the table with the label facing up and wait till the plot gets stabilised.
3. Place the SENSg device on the floor and you should see a slight rise in the reading.
4. While standing, hold the SENSg device up high and you should see a drop in the reading.



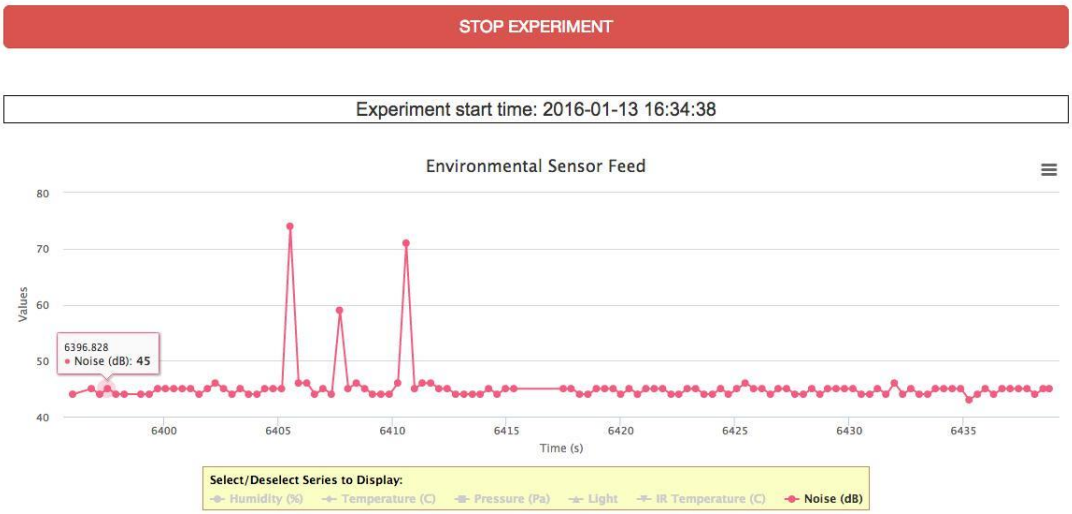
Light

1.Refresh the browser, choose light from the sensor selection menu and Start Experiment
2. Wait till the plot gets stabilised (roughly constant reading across time).
3. Place the SENSg device on the table with the label facing up. Cover the SENSg with your hand and remove the cover.
4. You should see a drop to zero every time you cover the SENSg.
5. Flash a torch at the SENSg device, and you should see a rise in the reading.



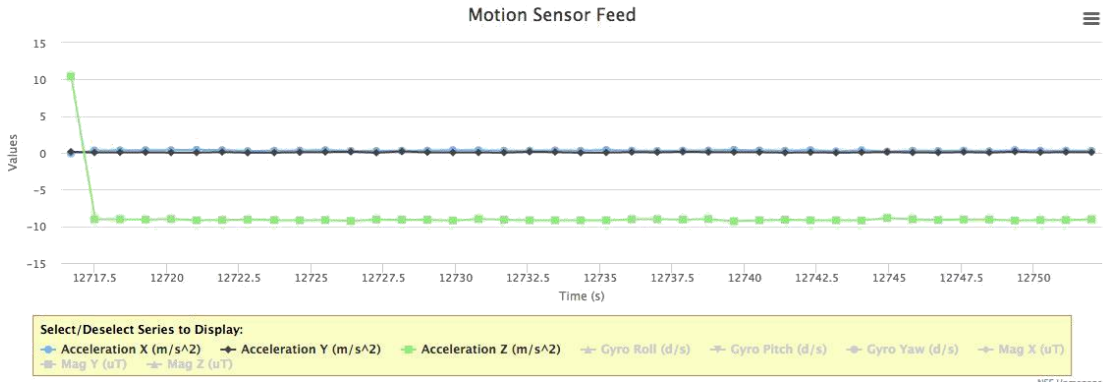
Noise

1. Refresh the browser , choose Noise from the sensor selection menu and Start the experiment.
2. Wait till the plot gets stabilised (roughly constant reading across time).
3. Place the SENSg device on the table with the label facing up. Clap three times with a pause in between.
4 Observe the in the sensor measurements, when you clap.



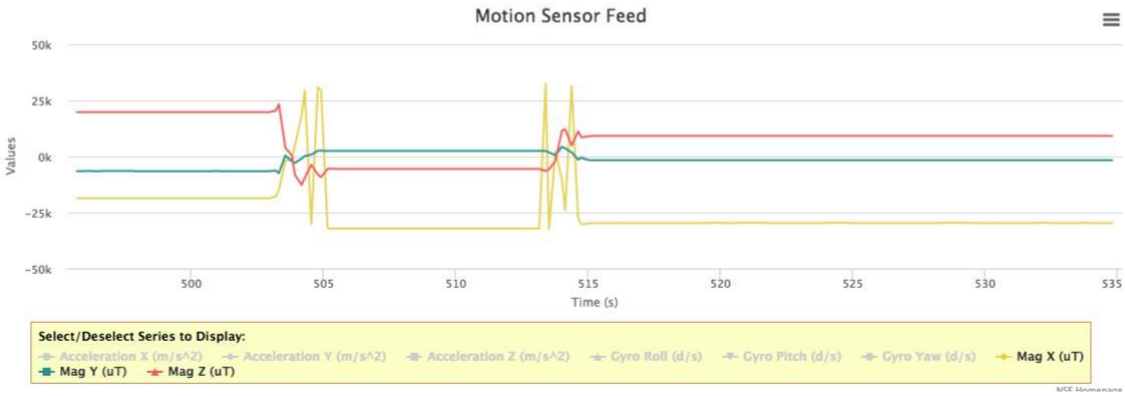
Accelerometer

1. Refresh, choose the acceleration X, Y and Z and Start Experiment
2. Place the device on the table with the SENSg label facing up and wait till the plot gets stabilised (roughly constant reading across time).
3. The Z reading should be 10 and X, Y should be 0.
4. Turn upside down and the Z reading should be -10 and X, Y should be 0.
4. Place the SENSg device on the table in the same direction as it is when hanging from the lanyard
5. The X reading should now be 10 and Y, Z should be 0
6. Place the SENSg device on the side with the buttons touching the table surface.
7. The Y reading should now be 10 and X, Z should be 0



Magnetometer

1. Refresh, choose the Mag-X, Mag-Y, Mag-Z and Start Experiment
2. Place the device on the table with the SENSg label facing up and wait till the plot gets stabilised (roughly constant reading across time).
3. Place the magnet on the device and check the readings.
4. Turn the magnet to the opposite side and observe if the readings change from negative to positive or vice verse.



Download sensor data and plots

Many of the classroom experiments require you to save a screenshot or download an image file in the form of JPEG/PNG/SVG. You can also download the data as an excel sheet or CSV file. The data files have this format for their column headers:

Environmental Sensor Feed	Motion Sensor Feed
1. Time 2. Humidity (%) 3. Temperature (°C) 4. IR Temperature (°C) 5. Pressure(Pa) 6. Light (lux) – relative light level 7. Sound Pressure Level i.e. Noise (dB)	1. Time 2. Acceleration-X (m/s^2) 3. Acceleration-Y (m/s^2) 4. Acceleration-Z (m/s^2) 5. Gyro Roll (d/s) 6. Gyro Pitch (d/s) 7. Gyro Yaw (d/s) 8. Magnetic Field X (uT) 9. Magnetic Field Y (uT) 10. Magnetic Field Z (uT)

Note : Timestamps correspond to GMT. Use online converter to view it in human readable format.
https://www.epochconverter.com/